

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 2 of 16

RECEIVED
CENTRAL FAX CENTER
JAN 30 2008

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application. Please amend the claims as indicated below:

1-24. (canceled)

25. (currently amended) A method [for]of demetallizing a web to make a singular functional feature of a product unit, the singular functional feature having a desired feature thickness and composed of structures formed on each side of the web, the method comprising:

applying a first etch-resistant pattern to a first metal-containing layer of the web, the first metal-containing layer being disposed on a first surface of a substrate consisting essentially of a polymer film, the first metal-containing layer being about one-half of a desired feature thickness, wherein at least a portion of the first pattern substantially defines a first part of the functional feature of the product unit;

applying a second etch-resistant pattern to a second metal-containing layer of the web, the second metal-containing layer being disposed on a second surface of the substrate opposite the first surface, the second metal-containing layer being about one-half of the desired feature thickness, wherein at least a portion of the second pattern substantially defines a second part of the functional feature of the product unit;

exposing both sides of the web to a liquid etchant to effect removal of metal-containing material from areas of the web not protected by the first and second etch-resistant patterns; and

washing the etchant from the web to expose the first and second parts of the functional feature, wherein

the first and second parts of the functional feature have a substantially identical length, width, and thickness, the width being substantially uniform along the length of the respective part of the functional feature, and

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 3 of 16

the first and second parts of the functional feature are disposed on the substrate in register with one another, such that the first and second parts of the functional feature are mirror images of one another on opposite surfaces of the substrate.

26. (original) The method of claim 25 wherein the exposing step comprises continuously passing the web in an immersed condition through a bath of liquid etchant.

27. (original) The method of claim 25 wherein the exposing step comprises exposing the web to sprays of liquid etchant.

28. (currently amended) A method of effecting selective demetallization of a web containing a flexible substrate layer to make a singular functional feature having a desired feature thickness and composed of structures formed on ~~each-side~~ opposite sides of the substrate layer, the method comprising:

applying a first patterned layer of sodium hydroxide-resistant material to a first aluminum layer disposed on a first surface of the substrate layer, the substrate layer consisting essentially of a polymer film, the first aluminum layer being about one-half of a desired feature thickness, wherein at least a portion of the first patterned layer substantially defines a first part of the functional feature;

applying a second patterned layer of sodium hydroxide-resistant material to a second aluminum layer disposed on a second surface of the substrate layer, the second aluminum layer being about one-half of a desired feature thickness, the second surface of the substrate layer being opposite the first surface, ~~[[and]]~~ wherein at least a portion of the second patterned layer substantially defines a second part of the functional feature;

continuously passing the web in an immersed condition through a bath of aqueous sodium hydroxide based solution to effect removal of aluminum from areas of the web not protected by the first and second patterned layers; and

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 4 of 16

washing the first and second aluminum layers free from spent sodium hydroxide based solution; to expose the first and second parts of the functional feature, wherein

the first and second parts of the functional feature have a substantially identical length, width, and thickness, the width being substantially uniform along the length of the respective part of the functional feature, and

the first and second parts of the functional feature are disposed on the substrate in register with one another, such that the first and second parts of the functional feature are mirror images of one another on opposite sides of the substrate.

29. (previously presented) The method of claim 25, wherein the first metal containing layer of the web and the second metal-containing layer of the web are of equivalent thickness.

30. (previously presented) The method of claim 25, wherein the portion of the second etch-resistant pattern is applied symmetrical to and in registration with the portion of the first etch-resistant pattern.

31. (previously presented) The method of claim 25 further comprising electrically connecting the first part of the functional feature to the second part of the functional feature.

32. (currently amended) A method of forming a single functional feature comprising:
selecting a desired feature pattern and a desired feature thickness;
apportioning the desired feature thickness into a first partial feature thickness and a second partial feature thickness;
providing a flexible substrate consisting essentially of a polymer film having a first side and a second side, wherein the first and second sides are opposite one another;
joining a first metal layer to the first side of the substrate and a second metal layer to the second side of the substrate;

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 5 of 16

applying an etch-resistant coating to the first metal layer in a first pattern corresponding to the feature pattern;

applying an etch-resistant coating to the second metal layer in a second pattern substantially corresponding to the mirror image of the feature pattern; and

exposing the first side and the second side of the substrate to an etchant to remove the metal not protected by the etch-resistant coating, thereby forming a first partial feature having the first partial feature thickness and a second partial feature having the second partial feature thickness, respectively, wherein

the first partial feature and the second partial feature have a substantially identical length, width, and thickness, the width being substantially uniform along the length of the respective partial feature, and

the first partial feature and the second partial feature are disposed on the substrate in register with one another, such that the first partial feature and the second partial feature are mirror images of one another on opposite sides of the substrate.

33. (previously presented) The method of claim 32, wherein apportioning the desired feature thickness into a first partial feature thickness and a second partial feature thickness comprises selecting the first partial thickness to be substantially equal to the second partial feature thickness.

34. (canceled)

35. (currently amended) The method of claim 32, wherein applying the etch-resistant coating to the second metal layer comprises substantially aligning the second pattern of etch-resistant coating with the first pattern of etch-resistant coating ~~such that the first partial feature and the second partial feature are substantially in registry.~~

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 6 of 16

36. (previously presented) The method of claim 32, wherein exposing the first side and the second side of the substrate to an etchant comprises immersing the substrate into a bath of aqueous etchant.

37. (previously presented) The method of claim 32, wherein exposing the first side and the second side of the substrate to an etchant comprises exposing the web to a spray of liquid etchant

38. (previously presented) The method of claim 32, further comprising winding the web onto a spindle.

39. (currently amended) A method of mitigating over-etching in forming a singular functional feature, comprising:

determining a desired total feature thickness;

apportioning the desired total feature thickness into a first partial feature thickness and a second partial feature thickness;

providing a substrate having a first side and a second side opposite the first side, wherein the substrate consists essentially of a polymer film;

forming a first partial feature from a first layer of metal overlying the first side of the substrate, the first partial feature having the first partial feature thickness;

forming a second partial feature from a second layer of metal overlying the second side of the substrate, the second partial feature having the second partial feature thickness; and

establishing a conductive path between the first partial feature and the second partial feature to form a single functional feature having the desired total feature thickness,

wherein

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 7 of 16

the first partial feature and the second partial feature have a substantially identical length, width, and thickness, the width being substantially uniform along the length of the respective partial feature, and

the first partial feature and the second partial feature are disposed on the substrate in register with one another, such that the first partial feature and the second partial feature are mirror images of one another on opposite sides of the substrate.

40. (withdrawn) The method of claim 39, wherein establishing a conductive path between the first partial feature and the second partial feature comprises contacting the first partial feature directly to the second partial feature.

41. (previously presented) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises:

allowing the first partial feature and the second partial feature to extend from an edge of the substrate; and

crimping the first partial feature and the second partial feature together.

42. (previously presented) The method of claim 39, wherein establishing a conductive path between the first partial feature and the second partial feature comprises fastening the first partial feature to the second partial feature.

43. (withdrawn) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises joining the first partial feature to the second partial feature using a conductive adhesive.

44. (withdrawn) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises using a conductive strip or clip to connect the first partial feature to the second partial feature.

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 8 of 16

45. (withdrawn) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the first partial feature, the substrate, and the second partial feature; and

filling the via with a conductive paste.

46. (withdrawn) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the first partial feature, the substrate, and the second partial feature; and

inserting a conductive fastener into the via.

47. (withdrawn) The method of claim 42, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the substrate and at least one of the first partial feature and the second partial feature; and

forming a weld between the first partial feature and the second partial feature through the via.

48. (withdrawn) The method of claim 39, wherein establishing a conductive path between the first partial feature and the second partial feature comprises:

extending a first lead from the first partial feature;

extending a second lead from the second partial feature; and

contacting the first lead to the second lead.

49. (currently amended) A method of forming a single functional feature comprising:

selecting a desired feature pattern and a desired feature thickness;

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 9 of 16

apportioning the desired feature thickness into a first partial feature thickness and a second partial feature thickness;

providing a flexible substrate consisting essentially of a polymer film having a first side and a second side, wherein the second side is opposite the first side;[[,]]

joining a first metal layer to the first side of the polymer film and a second metal layer to the second side of the polymer film;

applying an etch-resistant coating to the first metal layer in a first pattern corresponding to the feature pattern;

applying an etch-resistant coating to the second metal layer in a second pattern substantially corresponding to the mirror image of the first pattern and in registry with the first pattern;

exposing the first metal layer and the second metal layer to an etchant using a continuous process to remove the metal not protected by the etch-resistant coating, thereby forming a first partial feature having the first partial feature thickness and a second partial feature having the second partial feature thickness, respectively; and

establishing a conductive path between the first partial feature and the second partial feature to form a single functional feature having the desired feature pattern and the desired feature thickness,

wherein

the first partial feature and the second partial feature have a substantially identical length, width, and thickness, the width being substantially uniform along the length of the respective partial feature, and

the first partial feature and the second partial feature are disposed on the substrate in register with one another, such that the first partial feature and the second partial feature are mirror images of one another on opposite sides of the substrate.

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 10 of 16

50. (withdrawn) The method of claim 49, wherein establishing a conductive path between the first partial feature and the second partial feature comprises contacting the first partial feature directly to the second partial feature.

51. (previously presented) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises:

allowing the first partial feature and the second partial feature to extend from an edge of the substrate; and

crimping the first partial feature and the second partial feature together.

52. (withdrawn) The method of claim 49, wherein establishing a conductive path between the first partial feature and the second partial feature comprises fastening the first partial feature to the second partial feature.

53. (withdrawn) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises joining the first partial feature to the second partial feature using a conductive adhesive.

54. (withdrawn) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises using a conductive strip or clip to connect the first partial feature to the second partial feature.

55. (withdrawn) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the first partial feature, the substrate, and the second partial feature; and

filling the via with a conductive paste.

Response to Office Action mailed November 1, 2007
U.S. Application No. 09/989,898
Page 11 of 16

56. (withdrawn) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the first partial feature, the substrate, and the second partial feature; and

inserting a conductive fastener into the via.

57. (withdrawn) The method of claim 52, wherein fastening the first partial feature to the second partial feature comprises:

forming a via through the substrate and at least one of the first partial feature and the second partial feature; and

forming a weld between the first partial feature and the second partial feature through the via.

58. (withdrawn) The method of claim 49, wherein establishing a conductive path between the first partial feature and the second partial feature comprises:

extending a first lead from the first partial feature;

extending a second lead from the second partial feature; and

contacting the first lead to the second lead.